CORRECTIONS TO ATMOSPHERIC TURBIDITY AND WATER VAPOR VALUES AS COMPUTED FROM SOLAR RADIATION INTENSITY MEASUREMENTS AT THE BLUE HILL METEOROLOGICAL OBSERVATORY OF HARVARD UNIVERSITY DURING 1936

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[Research Associate, Harvard University, December 1936]

In August 1936, in response to a notice of the meeting of the Commission on Solar Radiation of the International Geodetic and Geophysical Union in Oxford, England, just prior to the meetings of the Union in Edinburgh, Scotland, in September, I sent my regrets that it would be impossible for me to attend these meetings.

At the same time I called attention to the fact that while many excellent measurements of the intensity of the total radiation, and of the radiation transmitted by standard color screens, had been received by me from a goodly number of stations, but few values of β, the coefficient of atmospheric turbidity, or of w, the precipitable water-vapor held in suspension in the atmosphere, had yet reached me from any foreign stations. Neither could I locate them in any library to which I had access.

In reply to my letter, Dr. Angström referred me to a paper by Von O. Hoelper, Aachen, Germany, published in the *Deutschen Meteorologischen Jahrbuch* for 1933. Hoelper's method of computing values of β and w differs from that followed in the United States, but it is believed that the two methods can be brought into accord. Already it is apparent that the American method is capable of improvement; and there are a few points in connection with the European method about which questions arise in my mind. In any case, the advantage that arises from international cooperation in this effort to study the characteristics of the different air masses that pass over us, some from Arctic regions, some from tropical oceanic regions, and some after marked changes have occurred as they passed over great land masses before reaching the points of observation, is a challenge to us to take advantage of all possible assistance, such as comes from an exchange of ideas in regard to difficulties encountered as the work progresses.

In the United States the atmospheric turbidity for dry air is determined from the differences in intensity of the screened readings (I_y-I_r); (see Mo. WEA. REV., March 1933, p. 82, fig. 4). With this turbidity value, the intensity for dry air in the total spectrum, I_m, may be obtained by entering Figure 2 of the same REVIEW, page 81, with the value of the turbidity factor, β, just found, and with the same air mass as before. Then subtract from this intensity the intensity I_m as measured at this same time; the remainder gives the absorption of radiation by the water-vapor present in the atmosphere above the place of observation, expressed in mm of water that would be obtained if all the water-vapor in the path of the beam were precipitated. Dividing by the square root of the length of the path, m, we obtain the depth of water in mm that would be obtained if all the water in a vertical path of unit cross section above the place of observation were precipitated.

It was found that the transmission of the two color screens increases considerably with decrease in temperature; and the changes for each screen are given in table 3, page 4, MONTHLY WEATHER REVIEW, January 1936.

These changes in the value of the transmission of the screens with temperature are of minor importance, but I was greatly shocked when I discovered that the mean of the values derived from I_y-I, and from I_m-I_y had been employed to determine the value of β for dry air. I very much regret this error, for which I assume the full responsibility.

Our values for September were at once recomputed, all values of β being derived from I_y-I_r, but the work could not be completed in time to include the results in the September REVIEW. The October values were then derived in the same way, but I was unable to prepare the present explanatory statement to accompany them.

In the meantime, I have received a letter from Dr. Feussner, of the Potsdam, Germany, Observatory, in which he suggests still further changes in the method of computing β and w.

Briefly, from I_m, the total radiation intensity, plus F, the depletion by moisture computed by the so-called equation of Fowle (but which Fowle repudiates; it is an equation proposed long ago by Hann as an approximate method), the intensity that would have been observed had the air been dry is obtained. Hoelper also suggests that his curves published in the *Deutschen Meteorologischen Jahrbuch* for 1933 be used in place of those published in the MONTHLY WEATHER REVIEW paper above cited.

I believe that it may be possible to use Hoelper's curves, thereby bringing about uniformity in reduction of observations, both in the United States and Europe. I do not believe, however, that Fowle's equation, referred to above, should be employed in determining the radiation that would have been obtained through dry air. This question will be taken up with the Smithsonian Institution without delay.

NOTES AND REVIEWS

J. Namias, Introduction to the Study of Air Mass Analysis (Review).—The American Meteorological Society has published, as its June–July 1936 *Bulletin*, an 84-page booklet embodying a third edition of Jerome Namias' Introduction to the Study of Air Mass Analysis and an abbreviated revision of H. C. Willett's Characteristic Properties of North American Air Masses. Namias has endeavored to answer the many questions that form in the mind of the beginner, and to provide the foundation necessary for the study of more advanced papers.

Stability and lapse-rates are the subjects of the first article. A concise table at the end of the discussion shows just what atmospheric conditions must obtain for each of the various types of equilibrium to exist.

The conservative properties of air masses next receive attention; and air masses themselves, temperatures (equivalent, potential, and equivalent-potential), lapse-rates, humidity (vapor pressure, relative humidity, absolute humidity, and specific humidity), condensation forms, visibility, and wind direction and velocity are defined and discussed. Definite clues are given which are helpful in identifying various types of air masses by means of these properties.

Following this there is an article on the plotting of the Rossby Diagram, giving in detail the meaning and derivation of the various scales appearing on the chart.

The interpretation of the Rossby Diagram follows; and the method of determining the type of air mass from the general type of the characteristic curve is given, together with the changes these curves undergo as the more common atmospheric processes, such as vertical displacement, occur. Definite statements are given as to how the slope of the curve indicates the stability of the layer in question; e. g., "If the equivalent-potential temperature increases with elevation, the state is one of stability with respect to dry or saturated air, and no adiabatic process performed upon the layer will render it unstable."

Articles follow on frontal structure, one on warm fronts and another on cold fronts. Diagrams show cross-sections of the fronts, and the distribution of the meteorological elements in their neighborhood.

Cyclonic structure receives consideration in the succeeding article; and with the aid of diagrams, Namias explains the formation and appearance of various fronts and frontal systems. Included in this article is a table giving the average changes in pressure, temperature, relative humidity, specific humidity, clouds, precipitation, visibility, and wind which occur with the passage of warm, cold, or occluded fronts.

Tephigrams are taken up in the next article, and the principles of this type of chart explained and discussed.

Four general types of thunderstorms, i. e., air-mass, frontal, orographic, and those occurring in horizontally converging air currents, are considered in the last article; the various aspects and characteristics of each are discussed, together with the relation of the tephigram, particularly as regards forecasting, to each.

An appendix presents Willett's "Characteristic Properties of North American Air Masses." It includes sections on the general classification of air masses, and on the significance of the properties of the principal air mass types in summer and winter. This discussion includes the results of recent investigations of the tropical air masses, especially the so-called Ts or S air.

A large selection of references for further reading in English, and a few in foreign languages, are given. Also, there is a glossary of technical terms used in the paper.—*Verne D. Steves.*

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[RICHMOND T. ZOCH, *in Charge of Library*]

By AMY D. PUTNAM

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